Packaged Literature Search 82-1

Hydrothermal Deposits

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THE PACKAGED SEARCH SERIES

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INTRODUCTION

The literature on hydrothermal deposits is not large, but extends well back in time. Rona (see citation number 0950911) has traced professional interest in this topic back to 1966. Interest in metalliferous muds and sediments, a related topic with citations represented in this Packaged Search, may extend back to 1948 or even earlier. Polymetallic sulfides are a class of hydrothermal deposits and consist of such minerals as iron, copper, and zinc sulfides with minor constituents of gold, silver, vanadium, beryllium, cobalt, and others. Sulfide deposits on land is also an extensive topic, and a few of these citations are highlighted here also. Aquatic Sciences and Fisheries Abstracts, from which this Search was taken, was found to be the most systematic of the databases examined in its coverage of marine polymetallic sulfides. However, some coverage of this topic currently exists in other databases.

The literature of polymetallic sulfides is expected to increase rapidly. Interest in this topic was stimulated by the discovery in 1981 of a large metallic sulfide deposit off the Galapagos Islands by Dr. Alexander Malahoff, Chief Scientist of the National Ocean Survey, NOAA.

The undersea deposit, located at a depth of 8,500 feet, has a potential of being as large as deposits currently mined on land. About 240 pounds of samples have been brought back to Washington. They contain copper, silver, iron, vanadium, tin, and other metals. The sulfides were formed by the venting of mineral-rich, superheated water through "smokers" or "stacks," chimney-shaped prominences located along fault faces at the bottom of the ocean in the Galapagos Ridge valley. The deposit is to date the most extensive of its kind known in the world.

This search is being produced to provide an introduction to this topic and to put it into historical perspective. Since the key term "polymetallic sulfides" does not characterize the relevant literature for more than a few recent years at best, the search strategy is necessarily empiric and was built up by iterative methods. The strategy employed is reproduced at the end of this publication.

1160615 211-10615
Umweltuntersuchungen zu einem Tiefsee-Bergbau-Projekt im Roten Meer.
Environmental Research accompanying a deepsea mining project in the Red Sea. Presented at:. Intermaritec '80, Hamburg. International Conference on Marine Sciences and Ocean Engineering Hamburg (GFR) 1980.
.Backen,H..; .Karbe,L..
Preussag AG, Hannover, GFR
~Intermaritec '80 Hamburg. International Kongress fuer Meeresforschung und Meerestechnik. Kongress-Berichtswerk.
, . Hamburg Messe und Congress~Hamburg (GFR)., 1980.
LANGUAGES: German
SUMMARY LANGUAGES: German ; English
DOC TYPE: Conference; Book
REPORT NO.: p 543-552
JOURNAL ANNOUNCEMENT: 8112
Metalliferous muds containing appreciable amounts of zinc, copper and silver are formed in the Atlantis II Deep in 2,000 m water depth in the central trough of the Red Sea. To assess the economic potential of these occurrences and to develop the necessary new technology for their recovery the Saudi Sudanese Joint Commission for the Exploitation of the Red Sea Resources has set up a comprehensive research and development program. A through study of environmental implications of ocean mining in the Red Sea is an integral and important part of this program. The work includes baseline studies in the fields of chemical oceanography, plankton, deep benthos and reef communities, current measurements and eco-toxicological and diffusion tests. It is planned to separate the sulfide minerals of the valuable metals on board the mining ship by flotation methods and re-discharge the tailings through a pipe at depth. A first mining test in 1979 demonstrated the technical feasibility of such a procedure and provided the opportunity to monitor the spreading of the tailings from the discharge point at 400 m depth. The first results indicate that the tailings should be confined to the biologically little active waters of the deep Central Red Sea trough below 800 m, and that solid concentrations in the tailing plume outside the vicinity of the discharge jet should be kept below 10 mg per litre seawater.
GEOGRAPHIC DESCRIPTORS: ISW, Red Sea
ENVIRONMENT: Marine
IDENTIFIERS: zinc; copper; silver
SECTION HEADING CODES: 2404; 2445

1159022 211-09022
Seafloor spreading centers. Hydrothermal systems.
.Rona,P.A..; .Lowell,R.P..
eds.
Benchmark Papers in Geology, vol. 56
, . Academic~London (UK)., 1980.
LANGUAGES: English
$45.00.
DOC TYPE: Book
REPORT NO.: 424 p
JOURNAL ANNOUNCEMENT: 8110
No abstract text.
DESCRIPTORS: seafloor spreading; hydrothermal activity
ENVIRONMENT: Marine
IDENTIFIERS: spreading centres
SECTION HEADING CODES: 2266; 2109; 2268

1158406 211-08406
Marine mineral resources.
.Rona,P.A..
Atl. Oceanogr. Meteorol. Lab., Miami, FL 33149, USA
Nat. Resour. Forum., 5(1), 89-95, (1981)
LANGUAGES: English
SUMMARY LANGUAGES: English
DOC TYPE: Journal Article
JOURNAL ANNOUNCEMENT: 8109
Marine mineral resources include various metallic and non-metallic minerals of differing origin and economic potential which occurs on or beneath the floor of the continental margin and ocean basin, and in the overlying water column. To facilitate their understanding, these resources are reviewed in terms of seabed region, process of origin, mode of occurrence, and world annual production.
DESCRIPTORS: mineral resources
ENVIRONMENT: Marine
IDENTIFIERS: metalliferous sediments; continental margins; ocean basins; water column; ferromanganese nodules
SECTION HEADING CODES: 2404

1156666 211-06666
Metalliferous muds in the Red Sea: a review of their discovery, exploration and development.
.Elgarafi,A..
Saudi-Sudanese Joint Comm. for the Development of Red Sea Resources, Jeddah, Saudi Arabia
Nat. Resour. Forum, 4(3), 324-327, (1980)
LANGUAGES: English
SUMMARY LANGUAGES: English
DOC TYPE: Journal Article
JOURNAL ANNOUNCEMENT: 8107
After the discovery of the Red Sea metalliferous muds in 1948, investigation during 1963-65 located, for the first time, the three most important Red Sea brine areas and revealed the existence of metal concentrates beneath the host brines. The metalliferous sediments were reported to contain high concentrates of sulphides valued at $2.5 billion (1969 prices) in situ. In 1969 industrial firms started exploration of the metalliferous sediments. The Saudi-Sudanese Joint Commission for the development of Red Sea Resources was established in 1975 and in 1976 it began execution of a six-year programme of activities organized into four stages. The current third stage includes a pre-pilot mining test during which 1,000 tons of mud are planned to be pumped to test the function of the mining equipment. The fourth stage will be a pilot mining test on a large scale.
DESCRIPTORS: mineral industry; metalliferous sediments; mineral exploration
GEOGRAPHIC DESCRIPTORS: ISW, Red Sea
ENVIRONMENT: Marine
IDENTIFIERS: brines; mud; metals; deep sea mining; ISW, Saudi Arabia; ISW, Sudan; sulphides
SECTION HEADING CODES: 2404

1154876 211-04876
Hydrothermal quartz vug from the Mid-Atlantic Ridge.
.Rona,P.A..; .Bostroem,K..; .Epstein,S..
NOAA, 15 Rickenbacker Causeway, Miami, FL 33149, USA
Geology, 8(12), 569-572, (1980)
LANGUAGES: English
SUMMARY LANGUAGES: English
DOC TYPE: Journal Article
JOURNAL ANNOUNCEMENT: 8106
A site dredged on the east wall of the rift valley of the Mid-Atlantic Ridge at lat 24.21'N is characterized by a low in residual magnetic intensity similar to that observed at the TAG Hydrothermal Field in a structurally equivalent position 250 km to the north. Tholeiitic basalts that have undergone hydrothermal alteration, forming chlorites, analcime, calcite, and quartz-rich rocks, were recovered. The quartz is a large remobilization product, occurring in cracks and vugs as massive fillings and euhedral crystals. Oxygen-isotope thermometry indicates that the quartz was deposited from hydrothermal solutions comprising either sea water at 200 C or primary water at 330 C, consistent with a history of intense hydrothermal activity and the use of the magnetic low as a signature to identify such activity.
DESCRIPTORS: hydrothermal alteration; basalts; hydrothermal activity; magnetic properties
GEOGRAPHIC DESCRIPTORS: AS, Mid-Atlantic Ridge
ENVIRONMENT: Marine
IDENTIFIERS: hydrothermal solutions; quartz
SECTION HEADING CODES: 2187; 2268

1152996 211-02996
Excess .SUP-3.He in the deep water over the Mid-Atlantic Ridge at 26.N: evidence of hydrothermal activity.
.Jenkins,W.J..; .Rona,P.A..; .Edmond,J.M..
Woods Hole Oceanogr. Inst., Woods Hole, MA 02543, USA
Earth Planet. Sci. Lett., 49(1), 39-44, (1980)
LANGUAGES: English
SUMMARY LANGUAGES: English
DOC TYPE: Journal Article
JOURNAL ANNOUNCEMENT: 8104
The authors have observed distinct and significant patterns of excess .SUP-3.He in bottom waters over the Mid-Atlantic Ridge in the 'TAG hydrothermal field'. The lateral regional gradients are comparable in magnitude to gradients observed in the Galapagos rift, an area of confirmed hydrothermal activity. Together with this, the .SUP-3.He pattern, magnitudes and vertical gradients all indicate on-going and continuous hydrothermal activity.
DESCRIPTORS: helium isotopes; hydrothermal activity
GEOGRAPHIC DESCRIPTORS: AS, Mid-Atlantic Ridge
ENVIRONMENT: Marine
IDENTIFIERS: spatial variations; bottom water; radioactive tracers
SECTION HEADING CODES: 2268; 2184

1152720 211-02720

Sulfur isotope systematics in Icelandic geothermal systems and influence of seawater circulation at Reykjanes.

.Sakai,H..; .Gunnlaugsson,E..; .Tomasson,J..; .Rouse,-J.E..

Inst. Thermal Spring Res., Okayama Univ., Misasa, Tottori-Ken, 682-02 Japan

Geochim. Cosmochim. Acta, 44(8), 1223-1231, (1980)

LANGUAGES: English

SUMMARY LANGUAGES: English

DOC TYPE: Journal Article

JOURNAL ANNOUNCEMENT: 8104

Pyrite from altered basalts from Namafjall and Krafla high-temperature fields and deep zones at Reykir, Leira and other low-temperature fields, and aqueous sulfides from Namafjall, have ..SUP-34.S values of 0 to 2.6 o/oo. These values are close to those for postglacial basaltic lavas from the Reykjanes Peninsula. The major source of sulfur in these meteoric hydrothermal systems is the upper-mantle or basalt. At the low-temperature fields, however, the ..SUP-34.S values of sulfide decrease with decreasing depth, suggesting the presence of a light sulfur source in the shallower aquifers. In contrast, in the Reykjanes and Svartsengi geothermal fields, where seawater contributes to the hydrothermal systems, sulfide sulfur is distinctly enriched in .SUP-34.S at all depths except for one Reykjanes pyrite from 84 m depth. The enrichment is about 8 o/oo at the deepest core (1734 m) of Reykjanes and decreases with decreasing depth. These enrichments are most likely due to seawater sulfate being involved in the hydrothermal systems. However, in the Reykjanes fluid, dissolved heavy sulfates are not in isotopic equilibrium with sulfide. Disequilibrium between sulfate and sulfide is also demonstrated in all other Icelandic geothermal systems studied.

DESCRIPTORS: sulphur isotopes; hydrothermal alteration

GEOGRAPHIC DESCRIPTORS: ANE, Iceland

ENVIRONMENT: Marine

IDENTIFIERS: diagenesis; hydrothermal activity; basalts; isotopic fractionation; sea water

SECTION HEADING CODES: 2187; 2268

1152694 211-02694

Sulfide precipitates at 21.N on the East Pacific Rise: .SUP-226.Ra, .SUP-210.Pb and .SUP-210.Po.

.Finkel,R.C..; .Macdougall,J.D..; .Chung,Y.C..

Scripps Inst. Oceanogr., La Jolla, CA 92093, USA

Geophys. Res. Lett., 7(9), 685-688, (1980)

LANGUAGES: English

SUMMARY LANGUAGES: English

DOC TYPE: Journal Article

JOURNAL ANNOUNCEMENT: 8104

Sulfide samples collected by the deep submersible ALVIN from hydrothermal vents at 21.N on the East Pacific Rise have extremely variable contents of uranium series nuclides. In samples the authors have analyzed, .SUP-210.Pb and .SUP-210.Po activities vary by more than an order of magnitude within the same vent. In two out of three samples measured .SUP-210.Po activities are higher than the parent .SUP-210.Pb activities. Consideration of .SUP-210.Pb/Pb in particulate sulfide filtered from hot vent water indicates that the lead in these deposits has a basalt as opposed to a seawater origin. Comparison of .SUP-210.Po and .SUP-210.Pb contents of active and inactive vent particulates suggests that the cycle of buildup, cesstion and decay by oxidation of these sulfide chimneys is measured in tens to a few hundreds of years.

DESCRIPTORS: sampling; sulphides; chemical precipitation; polonium isotopes; lead 210; radium isotopes; sediment analysis; hydrothermal deposits

GEOGRAPHIC DESCRIPTORS: INE, East Pacific Rise

ENVIRONMENT: Marine

IDENTIFIERS: submersibles; ALVIN

SECTION HEADING CODES: 2187

1152668 211-02668
Etude mineralogique d'echantillons du Golfe de Californie (campagne CYAMEX).
Mineralogical study of California Gulf samples (cruise CYAMEX).
.Picot,P..; .Fevrier,M..
BRGM, Dep. Mineralogie, Geochimie, Analyses, B.P. 6009, 45018 Orleans Cedex, France
Bureau de Recherches Geologiques et Minieres, Orleans (France).
Doc. BRGM, (no. 20)
, 1980.
LANGUAGES: French
DOC TYPE: Report
REPORT NO.: 70 p
JOURNAL ANNOUNCEMENT: 8104
About forty samples collected during CYAMEX expedition on the East Pacific Rise have been studied by the B.R.G.M. The mineralogy has been established with the help of various methods such as: thin and polished sections studies, X ray diffractometry, microprobe analysis and scanning electron microscopy. Ten Fe, Cu, Zn sulphides and about fifteen non metallic species have been described. Pyrite, marcasite, wurtzite, sphalerite, goethite and chalcopyrrhotite are the most frequent. The latter is a high temperature form of cubanite (Cu Fe.SUB-2.S.SUB-3.) which became stable through a quenching phenomena. Chalcopyrrhotite and chalcopyrite are usually associated and form exsolutions with either phase predominant. This could be the result of the demixion of an original Cu _ Fe _ S solid solution. Wurtzite and sphalerite represent the Zn S and Zn _ Fe _ S system. At an early stage wurtzite and a Cu _ Fe _ S solid solution would have been deposited. Later on cooling sphalerite and chalcopyrrhotite _ chalcopyrite would have been formed. Hydrothermal solutions would have then formed the other sulphides. Seawater alteration of the sulphides produced hydrated sulfates as well as hydrated hydroxides and chlorides. The isotopic studies of sulphur indicate that it has a mantle origin. The calculated isotopic equilibrium temperatures vary between 230 C and 570 C. Lower temperatures (150 C and 40 C) were sometimes obtained. Finally the sulphide ore deposits from the East Pacific Rise and continental ore deposits associated with ophiolitic complexes such as in Cyprus can hardly be compared from a mineralogical point of view.
DESCRIPTORS: mineralogy; hydrothermal solutions; sulphides; sediment analysis
GEOGRAPHIC DESCRIPTORS: ISE, East Pacific Rise
ENVIRONMENT: Marine
IDENTIFIERS: sediment sampling; X-ray diffraction; rise; CYAMEX; electron microscopy
SECTION HEADING CODES: 2187; 2264; 2272

1151854 211-01854
Naissance d'un ocean. CYAMEX.
Birth of an ocean. CYAMEX.
.Francheteau,J..; .Needham,D..; .Juteau,T..; .Rangin,C..
Cent. Oceanol. de Bretagne, B.P. 337, 29273 Brest Cedex, France
Centre Natl. pour l'Exploitation des Oceans, Brest (France).
, . COB~Brest (France)., 1980.
LANGUAGES: English ; French
Numerous photographs and pictures.
DOC TYPE: Book
REPORT NO.: 86 p
JOURNAL ANNOUNCEMENT: 8103
Gathered together in this book is a selection of the first photographs obtained from a manned submersible at the crest of the East Pacific Rise, a major segment of the mid-oceanic ridge. The photographs were taken on the expedition CYAMEX in February and March 1978, when French, American and Mexican scientists made twenty-two dives on the East Pacific Rise at the mouth of the Gulf of California. Of excellent quality considering the conditions under which they were taken, the photographs record the shifting scene of recently cooled lava flows, variegated hydrothermal deposits, open fissures and strange fauna that were revealed by the lights of the submersible Cyana. 2600 metres below the surface of the sea. Various results of the expedition, among them the discovery of mounds of massive, metal-rich sulphides and of large areas once covered by lakes of lava, represent useful advances in the understanding of the processes that create and shape the igneous oceanic floor, and of how these processes may differ from one part of the mid-oceanic ridge to another.
DESCRIPTORS: seafloor spreading; oceanic crust; photographs; mid-ocean ridges; CYAMEX; research programmes; hydrothermal activity; sulphides
GEOGRAPHIC DESCRIPTORS: ISE, California Gulf; ISE, East Pacific Rise
ENVIRONMENT: Marine
IDENTIFIERS: cruises; geomorphology
SECTION HEADING-CODES: 2266; 2109; 2105; 2261

1150393 211-00393

Metamorphic textures in Archean copper-zinc massive sulphide deposits.

.Rockingham,C.J..; *.Hutchinson,R.W..

Univ. Western Ontario, London, Ont. N6A 3K7, Canada

Can. Min. Metall. Bull., 73(816), 104-112, (1980)

LANGUAGES: English

SUMMARY LANGUAGES: English

DOC TYPE: Journal Article

JOURNAL ANNOUNCEMENT: 8101

A comparative study of sulphide textures has been carried out on samples from four Archean copper-zinc massive base metal sulphide deposits: Kidd Creek, Ontario Lake Dufault-Norbec, Quebec Hood River-41, NWT and Geco, Ontario. These deposits have undergone metamorphic recrystallization under a range of conditions, and results of this study indicate that certain sulphide textures may be used as qualitative indicators of metamorphic grade, whereas others cannot.

DESCRIPTORS: sulphides; metamorphic rocks; metamorphism; mineral deposits; grain size; mineralogy

GEOGRAPHIC DESCRIPTORS: Canada, Inland Waters

ENVIRONMENT: Brackish; Fresh

IDENTIFIERS: copper; zinc; Canada, Ontario, Kidd Creek; Canada, Quebec, Dufault-Norbec L.; Canada,Northwest Territories, Hood R.; Canada, Ontario, Geco; sediment texture; diagenesis; facies

SECTION HEADING CODES: 2272; 2187

1150363 211-00363

Geology of a submarine hydrothermal field, Mid-Atlantic Ridge, 26.N latitude.

.Temple,D.G..; .Scott,R.B..; .Rona,P.A..

Damson Oil Corp., 260 North Belt East, Houston, TX 77060, USA

J. Geophys. Res., 84(B13), 7453-7466, (1979)

LANGUAGES: English

SUMMARY LANGUAGES: English

DOC TYPE: Journal Article

JOURNAL ANNOUNCEMENT: 8101

A comparison of structural and lithologic features observed from two stereophotographic traverses of the Trans-Atlantic Geotraverse (TAG) hydrothermal field, 26.N, Mid-Atlantic Ridge, wih features of the French-American Mid-Ocean Undersea Study (FAMOUS) hydrothermal site and the Mounds hydrothermal field of the Galapagos spreading centre shows that all three areas have hydrothermal deposits with restricted and patchy lateral extent and are associated with closely spaced normal faults commonly of small displacement. No one lithology characterizes either the rocks or the sediments that underlie the hydrothermal deposits. Regions without hydrothermal manganese oxide deposits such as the rift valley at 37.N in the FAMOUS area exhibit larger and fewer faults and lack the abundant permeable semiconsolidated breccia seen at 26.N. Thus structural factors which facilitate hydrothermal circulation by enhancing permeability appear critical to hydrothermal deposition. Structural features of the rift valley wall at 26.N include inward facing normal faulting, outward facing normal faulting, and outward tilting by rotation of fault blocks. These observations support a viscous drag mechanism of uplift of the rift valley walls.

DESCRIPTORS: marine geology; lithology; mid-ocean ridges ; hydrothermal activity; FAMOUS

GEOGRAPHIC DESCRIPTORS: AS, Mid-Atlantic Ridge

ENVIRONMENT: Marine

IDENTIFIERS: underwater photography; faults; sediments; manganese oxide; rift valleys

SECTION HEADING CODES: 2266; 2268

1059860 210-09860

Extensional tectonics and mid-Palaeozoic massive sulfide occurrences in Europe.

.Sawkins,F.J..; .Burke,K..

Dep. Geol. and Geophys., Univ. Minnesota, Minneapolis, MN 55455, USA

Geol. Rundsch., 69(2), 349-360, (1980)

LANGUAGES: English

SUMMARY LANGUAGES: German ; English ; French ; Russian

DOC TYPE: Journal Article

JOURNAL ANNOUNCEMENT: 8012

The age and lithologic settings of mid-Paleozoic massive sulfide deposits in Central Europe and southwest Iberia are suggestive of extensional tectonic environments. This inference is supported by the facies configurations of contemporaneous clastic sediments, the presence of deepwater lithologies and pelagic faunas, and marked mafic-felsic bimodalism in associated volcanic rocks. The massive sulfide deposits of the Moravia-Silesia area, Rammelsberg, Meggen, and other deposits appear to have formed in the same tectonic environment one dominated by crustal extension. The important massive sulfide deposits of the southwest Iberian province formed somewhat later, but appear to be related to a phase of crustal extension initiated in the late Devonian time. These two sets of rifting (sensu latu) events correlate in time with Caledonide collision in the north and subsequent Acadian collision further south. The postulated extensional events thus may relate directly to these collisions. All the areas under consideration were subsequently affected by Hercynian compressional events. The high potash granites associated with Hercynian collisions are largely the products of crustal melting and consequently have associated with them ore deposits characterized by lithophile elements such as tin, tungsten and uranium. A significant fraction of the Paleozoic metallogeny of Europe can thus be understood in terms of extensional tectonic events followed by compressional events less than 100 m.y. later.

DESCRIPTORS: Paleozoic era; tectonics; sulphides; lithology

GEOGRAPHIC DESCRIPTORS: Europe

ENVIRONMENT: Marine

SECTION HEADING CODES: 2266; 2264; 2272

1058915 210-08915

The flow of hot saline solutions from vents in the sea floor - some implications for exhalative massive sulfide and other ore deposits: reply.

.Turner,J.S..; .Gustafson,L.B..

Res. Sch. Earth Sci., Australian Natl. Univ., P.O. Box 4, Canberra, A.C.T., Australia

Econ. Geol., 74(8), 1895, (1979)

LANGUAGES: English

DOC TYPE: Journal Article

JOURNAL ANNOUNCEMENT: 8011

The authors reply to comments made by Jones (1979), and clarify certain points raised concerning sulphide deposits. Despite evidence of detrital accumulations of sulphides in many massive sulphide deposits, in most cases relatively coarse fragments of ore or granular pyrite are generally seeen close to an identifiable vent area. In addition it is felt that graviy flow of slumped material is unlikely to produce a consistent and vertical zonation of metals even if multiple flows were involved.

DESCRIPTORS: sulphides; hot brines; sediment-water interface

ENVIRONMENT: Marine

SECTION HEADING CODES: 2268; 2187

1058914 210-08914

The flow of hot saline solutions from vents in the sea floor - some implications for exhalative massive sulfide and other ore deposits: discussion.

.Jones,H..

Esso Minerals Canada, Calgary, Alta., Canada

Econ. Geol., 74(8), 1894, (1979)

LANGUAGES: English

DOC TYPE: Journal Article

JOURNAL ANNOUNCEMENT: 8011

The author discusses a recent paper by Turner and Gustafson (1978), noting that their research is only of use in understanding exhalative massive sulphide deposits if the sulphides are precipitated from exhaled brines. Other points are made about the quantities of brine needed to form massive ponds to allow precipitation of sulphides, and the zoning of Cu-Zn in these deposits.

DESCRIPTORS: sulphides; sediment-water interface; hot brines

ENVIRONMENT: Marine

IDENTIFIERS: thermal conductivity

SECTION HEADING CODES: 2268; 2187

1058031 210-08031

Sulfide deposits from the East Pacific Rise near 21.N.

.Hekinian,R..; .Fevrier,M..; .Bischoff,J.L..; .Picot,-P..; .Shanks,W.C..

Cent. Oceanol. Bretagne, Brest Cedex 29273, France

Science (Wash.), 207(4438), 1433-1445, (1980)

LANGUAGES: English

SUMMARY LANGUAGES: English

DOC TYPE: Journal Article

JOURNAL ANNOUNCEMENT: 8010

Massive sulfide deposits were discovered from the diving saucer Cyana. on the accreting plate boundary region of the East Pacific Rise near 21.N. The deposits form conical and tubular structures lying on a basaltic basement. Mineralogical and geochemical analyses showed two main types of intimately associated products: a polymetallic sulfide-rich material composed of pyrite and marcasite in association, zinc-rich phases, and copper-rich compounds, and an iron-rich oxide and hydroxide material (also called gossan) composed largely of goethite and limonite. Silicate phases such as opaline, silica, iron-silicon clay, and trace amounts of mica and zeolite are encountered in both types of material. Possible mechanisms for the formation of the sulfide deposits on the East Pacific Rise are discussed.

DESCRIPTORS: sulphides; mineral deposits; geochemistry; mineralogy

GEOGRAPHIC DESCRIPTORS: ISE, East Pacific Rise

ENVIRONMENT: Marine

IDENTIFIERS: plate boundaries

SECTION HEADING CODES: 2272; 2404

1058027 210-08027

Geothermal system at 21.N, East Pacific Rise: physical limits on geothermal fluid and role of adiabatic expansion.

.Bischoff,J.L..

Pac.-Arctic Br. Mar. Geol., US Geol. Surv., Menlo Park, CA 94025, USA

Science (Wash.), 207(4438), 1465-1469, (1980)

LANGUAGES: English

SUMMARY LANGUAGES: English

DOC TYPE: Journal Article

JOURNAL ANNOUNCEMENT: 8010

Pressure-volume-temperature relations for water at the depth of the magma chamber at 21.N on the East Pacific Rise suggest that the maximum subsurface temperature of the geothermal fluid is about 420 C. Both the chemistry of the discharging fluid and thermal balance considerations indicate that the effective water/rock ratios in the geothermal system are between 7 and 16. Such low ratios preclude effective metal transport at temperatures below 350 C, but metal solubilization at 400 C and above is effective even at such low ratios. It is proposed that the 420 C fluid ascends essentially adiabatically and in the process expands, cools, and precipitates metal sulfides within the upper few hundred meters of the sea floor and on the sea floor itself.

DESCRIPTORS: geothermal fields; hydrothermal systems; sulphides; precipitation (chemistry); mineral deposits; hydrothermal solutions; physical properties

GEOGRAPHIC DESCRIPTORS: ISE, East Pacific Rise

ENVIRONMENT: Marine

IDENTIFIERS: adiabatic; water temperature; ocean floor; ores

SECTION HEADING CODES: 2272; 2187; 2404

1057874 210-07874

East Pacific Rise: hot springs and geopysical experiments.

.Spiess,F.N..; .Macdonald,K.C..; .Atwater,T..; .Ballard,R..; .Carranza,A..; .Cordoba,D..; .Cox,C..; .Diaz Garcia,V.M..; .Francheteau,J..; .Guerrero,J..; .Hawkins-,J..; .Haymon,R..; .Hessler,R..; .Juteau,T..; .Kastner,M..; .Larson,R..; .Leyendyk,B..; .Macdougall,J-.D..; .Miller,S..; .Normark,W..; .Orcutt,J..; .Rangin,C..

RISE Project Group.

Science (Wash.), 207(4438), 1421-1433, (1980)

LANGUAGES: English

SUMMARY LANGUAGES: English

DOC TYPE: Journal Article

JOURNAL ANNOUNCEMENT: 8010

Hydrothermal vents jetting out water at 380 . 30 C have been discovered on the axis of the East Pacific Rise. The hottest waters issue from mineralized chimneys and are blackened by sulfide precipitates. These hydrothermal springs are the sites of actively forming massive sulfide mineral deposits. Cooler springs are clear to milky and support exotic benthic communities of giant tube worms, clams, and crabs similar to those found at the Galapagos spreading center. Four prototype geophysical experiments were successfully conducted in and near the vent area: seismic refraction measurements with both source (thumper) and receivers on the sea floor, on-bottom gravity measurements, in situ magnetic gradiometer measurements from the submersible Alvin. over a sea-floor magnetic reversal boundary, and an active electrical sounding experiment. These high-resolution determinations of crustal properties along the spreading center were made to gain knowledge of the source of new oceanic crust and marine magnetic anomalies, the nature of the axial magma chamber, and the depth of hydrothermal circulation.

DESCRIPTORS: hydrothermal springs; hydrotheral systems; hydrothermal circulation; geophysical surveys

GEOGRAPHIC DESCRIPTORS: ISE, East Pacific Rise

ENVIRONMENT: Marine

IDENTIFIERS: mineral deposits; sulphides

SECTION HEADING CODES: 2261; 2272

1057528 210-07528

Near bottom water temperature anomalies: Mid-Atlantic Ridge crest at latitude 26.N.

.Rona,P.A..

NOAA, Atlantic Oceanogr. Meteorol. Lab., 15 Rickenbacker Causeway, Miami, FL 33149, USA

Geophys. Res. Lett., 5(12), 993-996, (1978)

LANGUAGES: English

SUMMARY LANGUAGES: English

DOC TYPE: Journal Article

JOURNAL ANNOUNCEMENT: 8010

Six water temperature anomalies were measured along two profiles each about 10 km in length at the TAG Hydrothermal Field on the east wall of the rift valley of the Mid-Atlantic Ridge at latitude 26.N. The temperature anomalies were measured using a 3 m-long vertical array of four thermistors towed within 20 m of the ocean bottom. The anomalies exhibit increases in potential temperature up to 0.127 C above ambient and inverse gradients warming downwards as great as 4.2 x 10.SUP--2..C m.SUP--1.. The temperature anomalies are distributed as point sourdes in a linear pattern about 7 km in length along known fault zones in the east wall of the rift valley between depths of 2750 and 3200 m below sea level associaged with hydrothermal mineral deposits. The characteristics of the temperature anomalies and their geologic setting indicate an origin by discharge of hydrothermal solutions through the faults in the rift valley wall. The magnitudes of the anomalies are consistent with values previously used to estimate a heat output of the order of several megawatts per kilometer of ridge at the TAG Hydrothermal Field.

DESCRIPTORS: bottom water; water temperature; temperature anomalies; hydrothermal activity

GEOGRAPHIC DESCRIPTORS: AS, Mid-Atlantic Ridge

ENVIRONMENT: Marine

IDENTIFIERS: hydrothermal solutions

SECTION HEADING CODES: 2165; 2268; 2146

0850212 208-00212

Econ. Geol.

Ore transport and deposition in the Red Sea geothermal system. Fall Meeting of the Society of Economic Geologists Denver, CO (USA) 9 Nov 1976.

Shanks, W.C.; Bischoff, J.L.

Geol. Dep., Univ. California, Davis, CA 95616, USA

, 72(4), 739-740, 1977

LANGUAGES: English

DOC TYPE: Conference; Journal Article

JOURNAL ANNOUNCEMENT: 7806

Thermodynamic calculation of distribution of dissolved aqueous species in the Red Sea geothermal brine provides a model of ore transport and deposition which is in excellent agreement with observed accumulations of base metal sulfides, anhydrite, and barite. The Red Sea brine is recirculated seawater which achieves high salinity by low temperature interaction with Miocene evaporites and is subsequently heated to temperatures > 200.degree.C by interaction with recent rift zone intrusive rocks. Oxygen isotope shift in the brine is prevented by high water-rock ratio and oxygen fugacity is controlled by magnetite-hematite equilibria. At temperatures up to 250.degree.C, NaSO.SUB-4..SUP--. and MgSO.SUB-4..SUP-O. are the dominant sulfur-bearing species. H.SUB-2.S forms by inorganic sulfate reduction at the higher temperatures, but is maintained at a uniformly low concentration of about 2 ppm by the strength the sulfate complexes. Chloride complexes solubilize metals at the higher temperatures, and, thus, sulfide and metals are carried together into the Atlantis II Deep. Below 150.degree.C the brine becomes supersaturated with respect to chalcopyrite, sphalerite, galena and iron monosulfide due to chloride complex dissociation. Sulfide precipitation rates, based on the rate of brine influx, are in excellent agreement with measured sedimentation rates. Anhydrite precipitates as crystalline fissure infillings from high temperature inflowing brine. Barite forms from partial oxidation of sulfides at the interface between the lower hot brine and the transitional brine layer.

GEOGRAPHIC DESCRIPTORS: ISW, Red Sea

ENVIRONMENT: Marine

IDENTIFIERS: salinity; chlorine compounds; sedimentation ; dissolved salts

SECTION HEADING CODES: 2186; 2187

1056660 210-06660

On the formation of metal-rich deposits at ridge crests.

.Edmond,J.M..; .Measures,C..; .Mangum,B..; .Grant,B..; .Sclater,F.R..; .Collier,R..; .Hudson,A..; .Gordon,L.I..; .Corliss,J.B..

Dep. Earth Planet. Sci., Massachusetts Inst. Technol., Cambridge, MA 02139, USA

Earth Planet. Sci. Lett., 46(1), 19-30, (1979)

LANGUAGES: English

SUMMARY LANGUAGES: English

DOC TYPE: Journal Article

JOURNAL ANNOUNCEMENT: 8009

Data from the hot springs at the Galapagos spreading center (T = 3-13 C) show depletions of the exiting waters in Cu, Ni, Cd, Se, Cr and U relative to ambient seawater. Manganese is strongly enriched. Iron shows highly variable behavior between vent fields but is in general low. The data confirm the occurrence of extensive subsurface mixing between the primary high-temperature, acid, reducing hydrothermal fluids and 'groundwater'. The composition of the latter is indistinguishable from that of the free water column adjacent to the ridge axis. The final solutions are on the boundary between those forming MnO.SUB-2. crusts and those producing iron-manganese rich sediments. The suite of metal rich deposits observed at ridge crests _ Mn-O, Fe-Mn-O, Fe-S _ can be explained as the manifestation of the degree of subsurface mixing, decreasing from >100:1 to <1:1 across the series (assuming an end-member temperature of 350 C).

DESCRIPTORS: metalliferous sediments; hydrothermal activity; interstitial waters; ferromanganese oxides; submarine ridges

GEOGRAPHIC DESCRIPTORS: ISE, Galapagos Spreading Centre

ENVIRONMENT: Marine

IDENTIFIERS: manganese; iron; sulphides; subsurface water; seafloor spreading

SECTION HEADING CODES: 2187; 2266; 2184

1055085 210-05085

Thallium: a sensitive indicator of rock/seawater interaction and of sulfur saturation of silicate melts.

.McGoldrick,P.J..; .Keays,R.R..; .Scott,B.B..

Geol. Dep., Sch. Earth Sci., Univ. Melbourne, Parkville, Vic., Australia

Geochim. Cosmochim. Acta, 43(8), 1303-1311, (1979)

LANGUAGES: English

SUMMARY LANGUAGES: English

DOC TYPE: Journal Article

JOURNAL ANNOUNCEMENT: 8007

Radiochemical neutron activation analysis for Tl in a number of young pillow basalts, hydrothermally altered basalts and associated hydrothermal and hydrogenous Mn crusts from the Mid-Atlantic Ridge and adjacent regions of the North Atlantic indicate that Tl is a sensitive indicator of both S saturation of silicate melts and of rock/seawater interactions. Rb-Cs-K-Tl trend lines for fresh MAR basalts (whose melts remained saturated with S during silicate fractionation) are distinctly different to Hawaiian basalts whose melts lost S during or prior to eruption, but were saturated with S at an earlier stage. Varying degrees of Tl enrichment are found in the hydrogenous Mn nodules (91,000 ppb), hydrothermal Mn crusts (2300-32,000 ppb), palagonitized glass (300-2700 ppb), hydrothermally altered basalts (1140-4560 ppb), and even slightly altered pillow interiors (11-45 ppb) relative to the fresh glasses (6-12 ppb). This enrichment has taken place due to incorporation of Tl into secondary silicate phases along with the alkalis and also due to co-precipitation of Tl with ferromanganese oxides and hydroxides. Thallium enrichment in the hydrothermal products is interpreted as being due to cooling and oxidation of hydrothermal fluids as these approached the sea floor. Haloes of Tl-enriched country rock may occur around sulfide deposits in which seawater has acted as the core fluid.

DESCRIPTORS: thallium; sulphur; basalts; seawater; igneous rocks

GEOGRAPHIC DESCRIPTORS: AN, Mid Atlantic Ridge

ENVIRONMENT: Marine

IDENTIFIERS: hydrothermal activity; pillow lava; silicates; ferromanganese nodules

SECTION HEADING CODES: 2272

1054778 210-04778

The formation of massive sulfide deposits on the sea floor.

.Solomon,M..; .Walshe,J.L..

Dep. Geol., Univ. Tasmania, Hobart, Tasmania, Australia 7005

Econ. Geol. Bull. Soc. Econ. Geol., 74(4), 797-813, (1979)

LANGUAGES: English

SUMMARY LANGUAGES: English

DOC TYPE: Journal Article

JOURNAL ANNOUNCEMENT: 8007

Salinity and temperature data from fluid inclusions in Cyprus and Kuroko massive sulfide deposits indicate that the ore solutions were buoyant on entering the sea water. They probably rose from the sea floor like axisymmetric conical plumes derived from a finite source or as line plumes from a linear source. The height to which they rose depended on the magnitude of the density gradients in the ambient sea water. However, in the region immediately above the outlet pipe, the effect of interference between the many vents making up the pipe and the effect of the anticipated very low flow rate probably caused necking of the plume and a drastic retardation of the normal loss of vertical velocity and buoyancy caused by entrainment of sea water. Solubility data for copper sulfides indicate that virtually all the copper was precipitated by quenching immediately above the vent. Precipitation of sphalerite (.galena) took place higher in the plume and the very fine grained particles of these phases were probably entrained in the plume, carried to considerable heights, and in many cases dispersed. During the inevitable slowing of the flow rate and cooling of the hydrothermal system, sphalerite (.galena) was precipitated immediately above the vent. This was probaly the most important way of forming vertically zoned Cyprus and Kuroka deposits. Thin, sheetlike, well-banded deposits like Rosebery and many in the Bathurst area of Canada, may have a different form because they developed in relatively shallow water. In this situation the plume, stagnating at the water surface, spreads laterally for considerable distances, raining sphaerite and galena to the sea floor.

DESCRIPTORS: sulphides; precipitation (chemistry); hydrothermal activity; depositional environment

GEOGRAPHIC DESCRIPTORS: MED, Cyprus; INW, Japan, Kuroko

ENVIRONMENT: Marine

IDENTIFIERS: ores; plumes (aquatic); mineral deposits

SECTION HEADING CODES: 2187; 2184

1054742 210-04742

On the formation of metal-rich deposits at ridge crests.

.Edmond,J.M..; .Measures,C..; .Mangum,B..; .Grant,B..; .Sclater,F.R..; .Collier,R..; .Hudson,A..; .Gordon,L.I..; .Corliss,J.B..

Dep. Earth Planet. Sci., Massachusetts Inst. Technol., Cambridge, MA 02139, USA

SUMMARY LANGUAGES: English

DOC TYPE: Journal Article

JOURNAL ANNOUNCEMENT: 8007

Data from the hot springs at the Galapagos spreading center (T = 3-13 C) show depletions of the existing waters in Cu, Ni, Cd, Se, Cr and U relative to ambient seawater. Manganese is strongly enriched. Iron shows highly variable behavior between vent fields but is in general low. The data confirm the occurrence of extensive subsurface mixing between the primary high-temperature, acid, reducing hydrothermal fluids and 'groundwater'. The composition of the latter is indistinguishable from that of the free water column adjacent to the ridge axis. The final solutions are on the boundary between those forming MnO.SUB-2. crusts and those producing iron-manganese rich sediments. The suite of metal rich deposits observed at ridge crests _ Mn-O, Fe-Mn-O, Fe-S _ can be explained as the manifestation of the degree of subsurface mixing, decreasing from >100:1 to <1:1 across the series (assuming an end-member temperature of 350 C).

DESCRIPTORS: metalliferous sediments; hydrothermal activity; interstitial water; ferromanganese oxides; submarine ridges

GEOGRAPHIC DESCRIPTORS: ISE, Galapagos Spreading Centre

ENVIRONMENT: Marine

IDENTIFIERS: manganese; iron; sulphide; subsurface water; seafloor spreading

SECTION HEADING CODES: 2187; 2266

1054739 210-04739
Metal enrichments in sediments from the TAG Hydrothermal Field.
.Cronan,D.S..; .Rona,P.A..; .Shearme,S..
Appl. Geochem. Res. Group, Dep. Geol., Imperial Coll., London SW7, UK
Mar. Min., 2(1-2), 79-89, (1979)
LANGUAGES: English
SUMMARY LANGUAGES: English
DOC TYPE: Journal Article
JOURNAL ANNOUNCEMENT: 8007
Metal distribution patterns in sediments from the TAG Hydrothermal Field on the Mid-Atlantic Ridge at 26.N indicate an overall enrichment of manganese relative to the North Atlantic average, and localized enrichments of Fe, Cu, and Zn in the vicinity of the supposed hydrothermal vents. These data indicate that metal dispersion haloes of the type occurring around the Atlantis II Deep in the Red Sea should not be sought as evidence for submarine hydrothermal activity on open ocean mid-ocean ridge segments, but that broad areas of manganese enrichment should be sought instead.
DESCRIPTORS: hydrothermal activity; geochemistry; metals ; manganese
GEOGRAPHIC DESCRIPTORS: AS, Mid-Atlantic Ridge
ENVIRONMENT: Marine
IDENTIFIERS: sediments; iron; copper; zinc
SECTION HEADING CODES: 2187; 2268; 2404

1050166 210-00166
Silver ore found on East Pacific Rise.
Anon.
Sea Technol., 20(5), 7, (1979)
LANGUAGES: English
DOC TYPE: Journal Article
JOURNAL ANNOUNCEMENT: 8001
During a French American expedition near to the mouth of the Gulf of Baja California last year off Mexico numerous bottom samples were taken from a hot springs area. The warm water emanates from a seafloor spreading zone of the East Pacific Rise in the general area of 21.N., 109.W. The samples taken from a depth of 3,300 m using the French submersible Cyana. yielded numerous sulphide ores. They showed Ag contents conservatively estimated at 500 ppm. Along with 23-28.7% Zn, 19.9-42.7% Fe and 2.2-6% Cu, the ores would be attractive for commercial exploitation. The material is typical of that found in the seafloor spreading ridge zones of the world, such as the Mid-Atlantic Ridge. It is the product of deep sea volcanic eruptions. The ridge zones differ from the hot springs of the Red Sea rift zone where the brine concentrations result from leaching.
DESCRIPTORS: silver; hot springs; seafloor spreading; zinc; iron; copper; ores; metals
GEOGRAPHIC DESCRIPTORS: PSW, Albatross Cordillera
ENVIRONMENT: Marine
SECTION HEADING CODES: 2187; 2272; 2266; 2404

0955256 209-05256
Decouverte par submersible de sulfures polymetalliques massifs sur la dorsale du Pacifique oriental par 21.N (projet 'Rita'). Note.
Massive deep-sea sulfide ore deposits discovered by submersible in the East Pacific Rise: project 'Rita'.
.Francheteau,J..; .Needham,D..; .Choukroune,P..; .Juteau,T..; .Seguret,M..; .Ballard,R.D..; .Fox,J..; .Normark,W..; .Carranza,A..; .Cordoba,D..; .Guerrero,J..; .Rangin,C..; .Bougault,H..; .Cambon,P..; .Hekinian,R..
Address not stated
C.R. Hebd. Seances Acad. Sci. Paris Ser. D, 287(16), 1365-1368, (1978)
LANGUAGES: French
SUMMARY LANGUAGES: English ; French
DOC TYPE: Journal Article
JOURNAL ANNOUNCEMENT: 7906
Massive zinc, copper and iron sulfide ore deposits have been found at the axis of the East Pacific Rise. Although several investigators had predicted their presence on the deep-ocean floor, there was no supporting observational evidence. The East Pacific Rise deposits represent an appealing modern analogue of Cyprus-type ores associated with ophiolitic rocks on land. They contain up to about 29% zinc metal and up to at least nearly 3% metallic copper. Their discovery will provide a new focus for deep-sea exploration, leading to new assessments of the concentration of noble metals in the upper layers of the oceanic crust.
DESCRIPTORS: sulphides; mineral resources; metals
GEOGRAPHIC DESCRIPTORS: PSW, Albatross Cordillera
ENVIRONMENT: Marine
IDENTIFIERS: zinc; copper; iron
SECTION HEADING CODES: 2404

0954940 209-04940

The flow of hot saline solutions from vents in the sea floor - some implications for exhalative massive sulfide and other ore deposits.

.Turner,J.S..; .Gustafson,L.B..
Res. Sch. Earth Sci., Australian Natl. Univ., Canberra, A.C.T. 2600, Australia

Econ. Geol., 73(6), 1082-1100, (1978)
LANGUAGES: English
SUMMARY LANGUAGES: English
DOC TYPE: Journal Article
JOURNAL ANNOUNCEMENT: 7906

A variety of fluid flow phenomena involving fluids with thermal and compositional variations are reviewed, first as they are observed in simple laboratory experiments and then as they may apply to the formation of sulfide deposits resulting from exhalation of hot saline solutions from vents in the sea floor. Of particular interest is the case where the effluent is both very salty and hot, so that the two properties have opposing effects on the density difference between the exhaled fluid and its surroundings. This can lead to a very nonlinear density behavior during mixing, which makes it possible for initially light fluid to become heavier than sea water and for an oscillating flow to develop. Even more important are the 'double-diffusive' effects which can occur because of the different molecular diffusion rates of the two properties. An outflow can separate into two parts, a hot, less concentrated plume which rises and a warm concentrated flow which spreads as a bottom current away from the source, maintaining a sharp boundary with the overlying sea water as it does so. If the hot salty fluid is injected into a density gradient, a situation which is typical of the ocean, a stratified lateral transport of the lighter fraction can result. For the heavier fraction, the effect of the combined processes is to maintain a stable boundary between the sea water and an exhaled hydrothermal ore solution, which might thus flow with minimal mixing along the sea floor over large distances to a distant depression before dumping its contained metals. A continuing inflow of dense fluid into such a depression produces a stable stratification, so that in a steady state the outflow spilling over the edge of the depression would be at a lower temperature and salinity and higher or lower f.SUB-02.. This condition provides a mechanism for localizing precipitation of sulfides within a small restricted depression from very large volumes of ore solution. Evidence of density stratification in the Bushveld Complex suggests the importance of related phenomena in the formation of layered igneous complexes. Analogous behavior in porous media is also indicated.

DESCRIPTORS: hot brines; sulphides; hydrothermal activity
ENVIRONMENT: Marine
IDENTIFIERS: ores
SECTION HEADING CODES: 2268

0954938 209-04938

Simulated low-grade metamorphism of metalliferous mud from the Red Sea Atlantis II geothermal deep.

.Mossman,D.J..; .Heffernan,K.J..
Dep. Geol. Sci., Univ. Saskatchewan, Saskatoon, Saskatch., Canada S7N OWO

Econ. Geol., 73(6), 1150-1154, (1978)
LANGUAGES: English
DOC TYPE: Journal Article
JOURNAL ANNOUNCEMENT: 7906

More than a dozen deeps containing hydrothermal sediments and in some cases associated with hot brines are located along the axial trough of the Red Sea (Coleman, 1974). Of these, the most detailed geological studies have been conducted on the hot brines and metalliferous deposits of the Atlantis II Deep (Degens and Ross, 1969). These deposits form the richest submarine metallic sulfide accumulation known. Previous studies by Mossman and Heffernan (1978) dealt with the mineralogy of a sediment core from the Atlantis II Deep emphasizing the possible role of chlorides in transport and deposition in this ore-forming environment. This paper reports further on the mineralogy and chemistry of this same core and, on the basis of experiments, reports metamorphic changes which this metal-rich sediment might undergo during burial metamorphism. Attention is focused on the opaque mineral phases. Brief comparisons are presented between Atlantis II metalliferous deposits and ancient stratabound sulfide ores.

DESCRIPTORS: hydrothermal activity; mineralogy; metamorphism
GEOGRAPHIC DESCRIPTORS: ISW, Red Sea
ENVIRONMENT: Marine
IDENTIFIERS: hot brines
SECTION HEADING CODES: 2268; 2272

0954767 209-04767
Amorphous copper and zinc sulfides in the metalliferous sediments of the Red Sea.
.Brockamp,O..; .Goulart,E..; .Harder,H..; .Heydemann,-A..
Sedimentpetrogr. Inst. Univ., Goldschmidtstr. 1, D-3400 Gottingen, GFR
Contrib. Mineral. Petrol., 68(1), 85-88, (1978)
LANGUAGES: English
SUMMARY LANGUAGES: English
DOC TYPE: Journal Article
JOURNAL ANNOUNCEMENT: 7906
Detailed studies on the copper and zinc distribution in metalliferous sediments from the Atlantis II Deep (Red Sea) demonstrate that beside chalcopyrite and sphalerite appreciable amounts of copper and zinc are found in X-ray amorphous copper and zinc sulfides not previously described. Only low contents of copper and zinc are present in nontronites, hydroxides and carbonates.
DESCRIPTORS: copper; zinc; metalliferous sediments
GEOGRAPHIC DESCRIPTORS: ISW, Red Sea
ENVIRONMENT: Marine
SECTION HEADING CODES: 2187

0953257 209-03257
Ore transport and deposition in the Red Sea geothermal system: a geochemical model.
Shanks,W.C.; Bischoff,J.L.
Geol. Dep., Univ. California, Davis, CA 95616, USA
Geochim. Cosmochim. Acta, 41(10), 1507-1519, (1977)
LANGUAGES: English
SUMMARY LANGUAGES: English
DOC TYPE: Journal Article
JOURNAL ANNOUNCEMENT: 7904
Thermodynamic calculation of distribution of dissolved aqueous species in the Red Sea geothermal brine provides a model of ore transport and deposition in good agreement with observed accumulations of base metal sulfides, anhydrite, and barite. The Red Sea brine is recirculated seawater that acquires high salinity by low-temperature interaction with Miocene evaporites and is subsequently heated to temperatures in excess of 200.degree.C by interaction with recent rift zone intrusive rocks. At temperatures up to 250.degree.C, NaSO.SUB-4..SUP--. and MgSO.SUB-4..SUP-0. are the dominant sulfur-bearing species. H.SUB-2.s forms by inorganic sulfate reduction at the higher temperatures but is maintained at a uniform concentration of about 2 ppm by the strength of the sulfate complexes. Chloride complexes solubilize metals at the higher temperatures, and thus sulfide and metals are carried together into the Atlantis II Deep. Below 150.degree.C, the brine becomes supersaturated with respect to chalcopyrite, sphalerite, galena, and iron monosulfide due to chloride-complex dissociation. Sulfide precipitation rates, based on the rate of brine influx, are in good agreement with measured sedimentation rates. Anhydrite precipitates as crystalline fissure infillings from high-temperature inflowing brine. Barite forms from partial oxidation of sulfides at the interface between the lower hot brine and the transitional brine layer.
DESCRIPTORS: models; brines; sulphur compounds; thermodyanmics; precipitation (chemistry); alkali metals; geochemistry
GEOGRAPHIC DESCRIPTORS: ISW, Red Sea
ENVIRONMENT: Marine
IDENTIFIERS: sodium; magnesium; hydrogen; water temperature
SECTION HEADING CODES: 2183

0952410 209-02410
Genesis of the Red Sea: metalliferous sediments.
Bignell,R.D.
Exploration Dep., Gulf Oil Co., 2, Portman St., London, W1H OAN, UK
Mar. Min., 1(3), 209-235, (1978)
LANGUAGES: English
SUMMARY LANGUAGES: English
DOC TYPE: Journal Article
JOURNAL ANNOUNCEMENT: 7903
The chemistry and mineralogy of the metalliferous sediments in the Red Sea are reviewed, and new aspects of the genesis of these deposits are presented. The major sites of metalliferous sediment deposition in the Red Sea are in the Atlantis II, Thetis, Nereus, and Gypsum Deeps. The sites of submarine mineralization along the rift zone are controlled by transform faulting. The metals are precipitated from paleo-Red Sea waters, which, during their passage through evaporites, sediments, and basalts underlying the Red Sea floor, leach salts and metals. The metals are derived from country rock (black shales and, to a minor extent, basalts), and are transported as chloride complexes. The Red Sea deposits are considered to resemble massive sulfide ores, typical of an early stage of rifting.
DESCRIPTORS: metalliferous sediment; mineralogy; metallogenesis; hydrothermal activity
GEOGRAPHIC DESCRIPTORS: ISW, Red Sea
ENVIRONMENT: Marine
IDENTIFIERS: geochemistry; rift valleys; transform faults; precipitation (chemistry); palaeooceanography; evaporites; sediments; basalts; chlorides; sulphides; ores
SECTION HEADING CODES: 2187

0951600 209-01600

Deep tectonics and associated ore deposits in the Aegean Area. Presented at: 6. Colloquium on the Geology of the Aegean Region Athens (Greece) 20 Sep 1977.

Papazachos,B.C.; Papadopoulos,G.A.
Univ. Thessaloniki, Geophys. Lab., Thessaloniki, Greece

LANGUAGES: English
SUMMARY LANGUAGES: English
DOC TYPE: Conference; Book
JOURNAL ANNOUNCEMENT: 7902

Geophysical and magmatic data suggest that there have been two distinct (in time and space) lithospheric subduction phases in the Aegean area during Cenozoic. The older phase is associated with a lithospheric plate dipping from the central to the northern Aegean area and was very active in Middle Tertiary but is now dying off. The other phase is associated with a lithospheric plate which has been dipping from the Mediterranean to the southern Aegean since late Miocene and which currently is very active. Known sites of iron, mixed sulfides, manganese, copper and molybdenum ore deposits occur above these two slabs and the southern boundaries of both northern and southern metallogenic regions coincide with the 70 km isodepths of the intermediate earthquakes. Most of these ore deposits are generated either by partial melting of oceanic crustal rocks which cope the underlying and descending lithospheric slabs or by partial melting of mantle material above the slabs.

GEOGRAPHIC DESCRIPTORS: MED, Aegean
ENVIRONMENT: Marine
IDENTIFIERS: Cenozoic era; lithosphere; iron; sulphides; manganese; copper; molybdenum; earthquakes; oceanic crust; mantle; geophysical data; magma
SECTION HEADING CODES: 2266

0950911 209-00911

Magnetic signatures of hydrothermal alteration and volcanogenic mineral deposits in oceanic crust.

Rona, P.A.
NOAA, Atmos. and Meteorol. Lab., Miami, FL, USA
J. Volcanol. Geotherm. Res., (3), 219-225, (1978)
LANGUAGES: English
DOC TYPE: Journal Article
JOURNAL ANNOUNCEMENT: 7901

The realization that hydrothermal mineral deposits including metallic oxides and sulfides can form at oceanic spreading centers (Bostrom and Peterson, 1966 Spooner and Fyfe, 1973 Hutchinson, 1973 Sillitoe, 1973 Bonatti, 1975) has stimulated the search for such deposits in oceanic crust. Although inaccessible to present exploitation, hydrothermal mineral deposits at oceanic spreading centers provide natural laboratories to study ore-forming processes, and knowledge of their distribution is necessary to evaluate the metallic mineral potential of oceanic crust. Only a few concentrated hydrothermal mineral deposits have so far been discovered at oceanic spreading centers, including the deposits of the Red Sea (Degens and Ross, 1969 Backer and Schoell, 1972), the TAG Hydrothermal Field on the Mid-Atlantic Ridge at latitude 26.degree.N (Rona et al., 1976), and the Mounds Hydrothermal Field at the Galapagos spreading center in the equatorial Pacific (Moore and Vogt, 1976 Corliss et al., 1976 Lonsdale, 1977). These hydrothermal deposits were found largely by trial and error bottom sampling. The need exists for rapid reconnaissance criteria to guide the slow and localized bottom sampling procedure to potential sites of hydrothermal mineral deposits in oceanic crust both at and away from the 52,000 km long oceanic ridge system. A growing body of field evidence supported by laboratory studies indicates that concentrated hydrothermal activity may affect the intensity of magnetization of basalt, producing a characteristic magnetic signature that may be associated with sites of hydrothermal mineral deposits.

DESCRIPTORS: hydrothermal activity; mineral exploration; basalts; magnetic data
ENVIRONMENT: Marine
SECTION HEADING CODES: 2404; 2269; 2268

0858712 208-08712

Metallogenesis of the Caribbean region.

Kesler, S.E.

Dep. Geol. Mineral., Univ. Michigan, Ann Arbor, MI 48109, USA

J. Geol. Soc. Lond., 135(4), 429-441, (1978)

LANGUAGES: English

SUMMARY LANGUAGES: English

DOC TYPE: Journal Article

JOURNAL ANNOUNCEMENT: 7812

The Caribbean region contains four island arcs. The Greater Antilles, on the north, and Venezuelan Antilles, on the south, underwent volcanism from early Cretaceous to Eocene time and the Lesser Antilles and Central America, on the eastern and western sides of the region, respectively, began major arc volcanism largely in early Cenozoic time and are still active. These areas expose three different levels in the metallogenic evolution of island arcs. The most mature arc, metallogenically, is northern Central America, which is underlain by pre-Mesozoic cratonic rocks and contains widespread precious- and base-metal vein mineralization associated with terrestrial silicic volcanic rocks, and smaller deposits of tungsten, antimony and mercury. Next in order of metallogenic maturity is southern Central America, where porphyry copper mineralization is abundant. Precious- and base-metal veins in silicic volcanic rocks are moderately well developed here and tungsten-antimony-mercury mineralization is lacking. Least metallogenically mature of the arcs are the Greater, Lesser and Venezuelan Antilles in which both silicic volcanic-associated vein mineralization and tungsten-antimony-mercury mineralization are lacking and porphyry copper and massive sulphide mineralization are widespread.

DESCRIPTORS: island arcs; metallogenesis

GEOGRAPHIC DESCRIPTORS: ASW, Caribbean

ENVIRONMENT: Marine

IDENTIFIERS: metals; mineralogy

SECTION HEADING CODES: 2272

0857194 208-07194

Hydrothermal systems at oeanic spreading centers: symposium report.

Rona, P.A.; Lowell, R.P.

NOAA, Washington, DC 20546, USA

Geology, 6(5), 299-300, (1978)

LANGUAGES: English

DOC TYPE: Conference; Journal Article

JOURNAL ANNOUNCEMENT: 7810

A half-day symposium, 'Hydrothermal Systems at Oceanic Spreading Centers', sponsored by the Geophysics Division of the Geological Society of America, was convened at the 1977 Annual Meeting of the Society. Only recently has the existence - much less the significance - of hydrothermal systems at oceanic spreading centers (active oceanic ridges and rift zones) been realized. It has been estimated that a volume of sea water equal to the world ocean convects through oceanic spreading centers on a time scale of 5 to 10 m.y., based on evidence from oceanic heat flow, hydrous metamorphosed oceanic crust, and isotopic composition of hydrated rocks. The voluminous hydrothermal circulation of sea water driven by intrusive heat sources at oceanic spreading centers facilitates the transport of material from the oceanic mantle to the oceanic crust and hydrosphere with major implications for global heat budget, geochemical mass balances, and metallic ore deposits. The symposium was planned to be representative rather than comprehensive, with presentations of selected theoretical, experimental, and field studies of hydrothermal systems at oceanic spreading centers. Short notes on the papers read at the symposium are given in this report.

DESCRIPTORS: conferences; hydrothermal activity; seafloor spreading

ENVIRONMENT: Marine

IDENTIFIERS: submarine ridges

SECTION HEADING CODES: 2268

0855783 208-05783
Criteria for hydrothermal mineral deposits in oceanic crust.
Rona, P.A.
NOAA Atl. Oceanogr. Meteorol. Lab., 15 Rickenbacker Causeway, Miami, FL 33149, USA
Econ. Geol., 73(2), 135-160, (1978)
LANGUAGES: English
SUMMARY LANGUAGES: English
DOC TYPE: Journal Article
JOURNAL ANNOUNCEMENT: 7808

Hydrothermal mineral deposits in oceanic crust include metalliferous sediments and encrustations and massive sulfides. The occurrence of these deposits is explained by the hypothesis that they are concentrated at the discharge zones of high intensity subsea-floor hydrothermal convection systems involving the circulation of sea water through oceanic crust and upper mantle at oceanic spreading centers. Criteria that have proven most useful for recognition of hydrothermal deposits in oceanic crust based on known deposits at oceanic spreading centers include petrology of the deposits and surrounding rocks structural conditions that create exceptionally high permeability and thermal gradients seismicity in the form of microearthuakes and earthquake swarms geochemical properties of hydrothermal discharge (.SUP-3.He, .SUP-222.Rn, ferric hydroxides, silica) contrasts in acoustic impedence between normal sea water and hydrothermal solutions anomalous gravity as an indicator of geologic structure electrical properties of the hydrothermal solutions and deposits an associated low in residual magnetic intensity attributed to hydrothermal alteration of the magnetic mineral component of basalt patterns of deposition in early rift and advanced oceanic ridge stages of opening of an ocean basin and distribution of hydrothermal deposits both parallel and perpendicular to an oceanic spreading center. The seismic, geochemical, acoustic, thermal, and certain electrical criteria are applicable to recognition of active discharge zones of subsea-floor hydrothermal convection systems. The petrologic, structural, gravity, magnetic, and other electrical criteria are applicable to recognition of hydrothermal deposits in all of oceanic crust which underlies ocean basins covering two-thirds of the Earth and is emplaced on land as ophiolites.

DESCRIPTORS: minerals; hydrothermal activity; gravity anomalies; electrical properties
ENVIRONMENT: Marine
IDENTIFIERS: oceanic crus; petrology; seafloor spreading
SECTION HEADING CODES: 2272

0854809 208-04809
Precambrian stromatolite and other structures in the Rajpura-Dariba polymetallic ore deposit, Rajasthan, India.
Deb, M.; Banerjee, D.M.; Bhattacharya, A.K.
Dep. Geol., Univ. Delhi, Delhi, India
Mineral. Deposita (Berl.), 13(1), 1-9, (1978)
LANGUAGES: English
SUMMARY LANGUAGES: English
DOC TYPE: Journal Article
JOURNAL ANNOUNCEMENT: 7807

Intimate association of about 2 billion years old stromatolite with pyritic lead-zinc ores in the Precambrian polymetallic deposit at Rajpura-Dariba in Rajasthan, which hitherto remained unreported, provides an additional documentation of the syn(-dia)-genetic mineralization. The growth form and petrography of the stromatolite structure have been described and an explanation sought regarding the concentration of sulfides along the siliceous and carbonaceous laminations, as well as in the inter-columnar regions. Consideration of the geologic features noted in the mineralized zone and surrounding region suggests that the stratiform ores were deposited in a near-shore shallow marine environment, developed on basement highs and associated with euxinic conditions. Later, the ores were metamorphosed under conditions reaching upto amphibolite facies during a three-stage deformational history of their enclosing rocks. Some salient features of the secondary structures in the ores have been discussed in relation to this deformation history.

DESCRIPTORS: Precambrian era; calcareous sediments; ores
GEOGRAPHIC DESCRIPTORS: India, Rajasthan
ENVIRONMENT: Marine
IDENTIFIERS: shallow water; algae; lead; zinc
SECTION HEADING CODES: 2264

0853898 208-03898
Plate tectonics and mineral exploration.
Rona, P.A.
NOAA, Miami, FL, USA
Nat. Resour. Forum., 1(1), 17-28, (1976)
LANGUAGES: English
DOC TYPE: Journal Article
JOURNAL ANNOUNCEMENT: 7806

At a time of growing scarcity of critical minerals, plate tectonics is a revolutionary advance in our geological understanding of the earth that can guide exploration to areas of new deposits. Yet the potential of plate tectonics in mineral exploration is impeded by a communication gap between academic scientists, who are developing the science of plate tectonics, and industrial scientists, who are involved in mineral exploration programs. This article breaks new ground in closing this communication gap and showing how plate tectonics can guide exploration for petroleum and metals.

DESCRIPTORS: tectonics; mineral resources; underwater exploration
ENVIRONMENT: Marine
SECTION HEADING CODES: 2266

0853897 208-03897

A model for the process of formation of the upper oceanic crust.

Kidd, R.G.W.

Sch. Environ. Sci., Univ. East Anglia, Norwich NR4 7TJ, UK

Geophys. J.R. Astron. Soc., 50(1), 149-183, (1977)

LANGUAGES: English

SUMMARY LANGUAGES: English

DOC TYPE: Journal Article

JOURNAL ANNOUNCEMENT: 7806

It appears that certain features of ophiolites can only have been formed by conveyor belt type sea-floor spreading. Computer simulations of these features are used to derive a model for the formation of the upper oceanic crust. Detailed structural studies of complete ophiolites reveal a remarkably consistent structure of their upper portions: lavas with occasional dykes grade down through a rapid transition into a sheeted dyke layer, which in turn grades down into gabbro through a second equally sharp transition. Where sufficient sections can be measured sheeted dyke units show consistent one way chilling, there usually being about 10 per cent more margins chilled one way than the other. Two entirely independent computer simulations (of one way chilling, and of the increase in dyke percentage with depth in ophiolites) show that most of the dykes in their sheeted dyke units were intruded at spreading axes in zones less than 50 m wide. The dykes are intruded vertically, and subsequently both dykes and lavas may be rotated by tectonic activity and buried by more lavas as they migrate out of the roughly 4 km wide zones of lava formation. This model of formation of oceanic crust based on ophiolite data is consistent with observations on the present mid-ocean ridges. It appears that similar processes involving a narrow zone of dyke intrusion are developed at all spreading plate boundaries where the spreading rate is greater than about 10 mm/yr, irrespective of possible variations in spreading rate or tectonic setting of the spreading axis. From the model a number of features of the oceanic crust can be explained: (1) the shape of the boundaries between the blocks that produce magnetic anomalies (2) upwelling of hydrothermal circulation will be most intense in the axial 1 km at spreading axes (3) sulphide deposits are most likely to be formed in this axial 1 km and will then be buried by subsequent lava flows and (4) metamorphism of the upper oceanic crust will be greatest in this axial zone so that metamorphic layering is produced as an integral part of the formation of the oceanic crust and not as a result of subsequent burial.

DESCRIPTORS: submarine crust; models; petrology; ophiolites; submarine ridges

ENVIRONMENT: Marine

IDENTIFIERS: seafloor spreading

SECTION HEADING CODES: 2266

0853234 208-03234

Trace element mobility during hydrothermal alteration of oceanic basalts.

Humphris, S.E.

Dep. Geol., Imperial Coll., Prince Consort Road, London SW7 2BP, UK

Geochim. Cosmochim. Acta, 42(9), 127-136, (1978)

LANGUAGES: English

SUMMARY LANGUAGES: English

DOC TYPE: Journal Article

JOURNAL ANNOUNCEMENT: 7805

Trace element analyses have been carried out on hydrothermally altered pillow basalts of greenschist facies dredged from the median valley of the Mid-Atlantic Ridge. Sr is leached from the rock, and its behavior is apparently controlled by the same reactions as Ca. Cu is also leached from the basalt, but often shows local precipitation in veins as sulfides. Fe, B, Li, Ba, Mn, Ni and Co show sufficient variations in concentration and location within the altered basalts to indicate that some mobilisation occurs, but there may be subsequent uptake or precipitation into the secondary mineral assemblages. V, Y, Zr and Cr do not appear to be affected by hydrothermal alteration. The production of a metal-enriched solution by hydrothermal alteration and subsequent precipitation of metal salts to form metalliferous sediments is indicated, as is precipitation of metal sulfides in the basaltic basement.

DESCRIPTORS: hydrothermal activity; trace elements; basalts

GEOGRAPHIC DESCRIPTORS: A, Mid-Atlantic Ridge

ENVIRONMENT: Marine

IDENTIFIERS: mineralogy

SECTION HEADING CODES: 2272

0852323 208-02323

Crest of the Mid-Atlantic Ridge at 26.degree.N.

McGregor, B.A.; Rona, P.A.

NOAA Atl. Oceanogr. Meteorol. Lab., Miami, FL 33149, USA

J. Geophys. Res., 80(23), 3307-3314, (1975)

LANGUAGES: English

SUMMARY LANGUAGES: English

DOC TYPE: Journal Article

JOURNAL ANNOUNCEMENT: 7804

A relatively detailed investigation of the Mid-Atlantic Ridge crest at 26.degree.N was conducted by using narrow-beam bathymetric data, total earth's magnetic field measurements, and underwater photographs. The Mid-Atlantic Ridge crest at 26.degree.N appears to be hydrothermally active. The structural settig of this area is conductive to the occurrence of hydrothermal deposits. The walls of the rift valley are extensively faulted with blocks and steps ranging in size from kilometers to meters in width and relief. Underwater photographs show hydrothermal manganese associated with interpreted fault steps at depths between 3100 and 2500 m on the east wall, suggesting that the faults provide avenues for hydrothermal fluids. Small topographic highs in the floor of the rift valley are the sites of relatively recent volcanism and are believed to represent the top of an active dike emplacment zone. Bathymetric trend directions for this portion of the ridge crest are complex in comparison with plate rotation predicted trends for the Mid-Atlantic Ridge. The bathymetric grain is a function of processes active in the rift valley.

DESCRIPTORS: submarine ridges; bathymetry; morphology; hydrothermal systems; manganese; faults; rift valleys

GEOGRAPHIC DESCRIPTORS: AS, Mid-Atlantic Ridge

ENVIRONMENT: Marine

IDENTIFIERS: geomagnetism; underwater photography; fracture zones

SECTION HEADING CODES: 2263

0851846 208-01846

Mid ocean ridge mineralization and hot brines. Presented at Joint Oceanographic Assembly: Edinburgh (UK) 13 Sep 1976.

Ross, D.A.

Woods Hole Oceanogr. Inst., Woods Hole, MA 02543, USA

PUBL: FAO, Rome (Italy), 1976, S.9, 63

LANGUAGES: English

DOC TYPE: Conference; Summary; Book

JOURNAL ANNOUNCEMENT: 7803

Although metalliferous sediments can form on or under the sea floor by several processes, it is the hydrothermal mechanism that has provoked much recent interest and exploration. Hydrothermal deposits are commonly found in present or past tectonically-areas that have undergone igneous and/or hydrothermal activity. These sediments are commonly enriched in elements like Fe, Mn, Cu, Zn, Co, Cr, Ag, Ni and various sulfide phases, relative to neighboring deep-sea-sediments. Such hydrothermal deposits or enrichments have been found along portions of the active ocean ridges of the Atlantic, Pacific and Indian Ocean as well as in the Red Sea-Afar area. Their association with modern (or ancient) areas of sea-floor spreading is clearly related to hydrothermal circulation resulting from extension and convective processes. Three such areas have recently been studied in considerable detail: the Red Sea-Afar region the Nasca Plate in the Pacific and the FAMOUS area in the Atlantic, but only the Red Sea locality seems to have the promise of being an economic deposit.

GEOGRAPHIC DESCRIPTORS: Nazca Plate; ISW, Red Sea; A, Atlantic

ENVIRONMENT: Marine

IDENTIFIERS: sea floor spreading; hydrothermal metamorphism

SECTION HEADING CODES: 2404

0851691 208-01691

Geophysical investigation of the Cape Verde archipelago.

Dash, B.P.; Ball, M.M.; King, G.A.; Butler, L.W.; Rona, P.A.

Dep. Geophys., Imperial Coll. Sci. Technol., London SW7 2BP, UK

J. Geophys. Res., 81(29), 5249-5259, (1976)

LANGUAGES: English

SUMMARY LANGUAGES: English

DOC TYPE: Journal Article

JOURNAL ANNOUNCEMENT: 7803

The Cape Verde Islands are emerged portions of a Mesozoic-Cenozoic volcanic accretion in the form of a westward-opening horseshoe along fracture zones converging from the mid-Atlantic ridge toward Africa. An interior abyssal plain slopes westward, increasing in depth from 2.7 to 4.5 km. The plain is underlain by low relief on acoustic basement that is associated with a 300-gamma negative magnetic anomaly. The flanks of the Sal-Maio ridge appear bounded by large-displacement normal faults superficial slumping is common. The trends of magnetic anomalies are linear N-S north of the islands and less linear within the islands and may change coincident with E-W bathymetric trends south of the islands. A triangular pattern of reversed refraction lines 200-250 km long along the north and eastridges and NW-SE across the interior abyssal plain indicated 2-3 km of semiconsolidated sediments underlain by 3-6 km of basalt and 6-8 km of plutonic rocks. The depth of the Moho is between 16 and 17 km. A deep NW-SE trending fault intersects the Sal-Maio ridge near Boa Vista. The consistent depth to Moho and the regional Bouguer anomaly indicate lack of local relief at the base of the crust. The crustal load of the entire archipelago is regionally adjusted.

DESCRIPTORS: fracture zones; Bouguer anomaly; magnetic anomalies; submarine volcanoes; Cretaceous; geological survey

GEOGRAPHIC DESCRIPTORS: ASE, Cape Verde Is.

ENVIRONMENT: Marine

IDENTIFIERS: submarine crust

SECTION HEADING CODES: 2266

0850215 208-00215

.SUP-87.Sr enrichment of ophiolitic sulphide deposits in Cyprus confirms ore formation by circulating seawater.

Chapman, H.J.; Spooner, E.T.C.

Dep. Geol. Mineral., Univ. Oxford, Oxford OX1 3PR, UK

Earth. Planet. Sci. Lett., 35(1), 71-78, (1977)

LANGUAGES: English

SUMMARY LANGUAGES: English

DOC TYPE: Journal Article

JOURNAL ANNOUNCEMENT: 7806

The hypothesis that seawater was the source of the hydrothermal fluid which formed the Upper Cretaceous ophiolitic cupriferous pyrite ore deposits of the Troodos Massif (Cyprus) has been tested by analysing the strontium isotopic composition of 13 mineralized samples from 4 mines. Initial .SUP-87.Sr/.SUP-86.Sr ratios range from 0.7052 . 0.0001 to 0.7075 . 0.0002, the latter value being indistinguishable from that of Upper Cretaceous seawater at 0.7076 . 0.0006 (2.sigma.). Hence, the mineralized metabasalt samples have been contaminated with .SUP-87.Sr, relative to initial magmatic strontium isotope ratios of the Troodos ophiolitic complex (0.70338 . 0.00010 to 0.70365 . 0.00005). Since seawater was the only source of strontium available during formation of the Troodos Complex which was isotopically relatively enriched in .SUP-87.Sr, the data confirm that seawater was the source of the hydrothermal ore-forming fluid.

DESCRIPTORS: strontium; water circulation; geochemistry

GEOGRAPHIC DESCRIPTORS: Cyprus

ENVIRONMENT: Marine

IDENTIFIERS: sea water

SECTION HEADING CODES: 2187; 2164

.overall 67mk

Line	Set	Command
1	1	#SULFID? OR SULPHID?
2	2	#RICH OR ACCRET(F)PLAT?
3	3	#MALAHOFF OR ALVIN OR ANGUS OR ASTORIA OR ATLANTIC OR ATLANTIS OR BISMARCK
4	4	#BLACK(W)SMOKERS OR CADMIUM OR CALIFORNIA OR CARIBBEAN OR CARLSBURG OR COBALT
5	5	#COCOS OR COPPER OR CRUSTAL OR CYANA OR DANDELION(W)PATCH OR DAVE(W)CLAGUE OR DEPOSIT? OR PACIFIC(W)RISE
6	6	#CYAMEX OR DAVID(W)CLAGUE OR FRACTURE OR ECONOMIC(W)ZONE OR FAMOUS(W)EXPERIMENT OR FIJI OR GALAPAG? OR GEOSTILL OR GOETHITE OR GOLD OR GORDA
7	7	#GOSSAN OR GUAYAMAS OR HOT(W)VENT OR HOT(W)VENTS OR HYDROTHER? OR HYDROZID? OR INDIAN(W)OCEAN OR IRON OR FERRIC OR FERROUS OR JEAN(W)CHACOT
8	8	#METALLIC OR POLYMETALLIC OR POLY(W)METALLIC OR METALLIFEROUS OR JOHN(W)CORLISS OR JUAN(F)FUCA OR LEAD OR LIMONITE OR LO)HI OR MARCASITE
9	9	#MARGINAL(F)BASIN? OR MARINE OR MASSIF? OR MENDOCIN OR METAL? OR MINERAL OR RIDGE OR MOLYB? OR NAZCA OR NICKEL
10	10	#MINING OR MINES OR OCEAN? OR OPHIOLIT? OR ORE OR ORES OR ORE(W)BEAR? OR ORE(W)FORM? OR ORE(W)BOD? OR OREGON OR PACIFIC? OR PLATY OR PYRIT? OR RED(W)SEA

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Line Set Command
  11  11  #RIFT OR ROBERT(W)EMBLEY OR SAVANCO OR SEA OR SEAS OR SEA(W)CLIFF
          OR SEABEAM OR SILVER OR SMOKER OR SMOKERS OR SP(W)LEE OR SPREADIN
          G(W)CENTER?
  12  12  #STEPHEN(W)HAMMOND OR SEDIMENT? OR MUD? OR STACK? OR SURVEYOR OR
          TAG OR HYDROTHERMAL OR TIN OR TUBUL? OR VANADIUM OR VENT OR VENTS
          OR WASHING? OR ZINC?
  13  13 C 2-12/+
  14  14 C 1*13
  15  15  #CORROS? OR CORROD? OR POLLUT? OR MANGANESE(W)NODUL?
  16  16 C 14-15
  17  17  #EN=MARINE
  18  18 C 16*17
  19  19  #EUTROPH?
  20  20  #EN=BRACKISH
  21  21 C16*(17+20)
  22  22 C21-19
  23  23  #PROJECT(W)RITA
  24  24  #PLACER OR PLACERS
  25  25 C16+23+24
  26  26 C25*(17+20)
  27  27 C26-19
  28  28  #BACTER? OR MICROORG? OR MEIOFAUN? OR FOSSIL? OR MICROFOSSIL? OR
                                                                    -more-
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      PENGUIN?
29    29 C27-28
30    30 C1*29
31    31  #METALLIFER?(F)MUD?
32    32  #SULFIDE?(W)PRECIPITATE?(F)RISE/TI
33    33  #CYAMEX/TI OR MASSIVE(W)SULFIDE OR DEPOSITS/TI OR MASSIVE(W)SULPH
      ID?
34    34  #SUL?(W)DEPOSIT?/TI
35    35  #GEOTHERMAL(W)SYSTEM?/TI
36    36  #PACIFIC(W)RISE/TI
37    37  #ATLANTIC(W)RISE/TI
38    38  #METAL(W)RICH OR METAL-RICH
39    39  #DEPOSITS/TI OR THALLIUM/TI OR RIDGE(F)CRESTS/TI
40    40  #ORE/TI OR ORES/TI OR RITA/TI OR VENTS/TI OR RED(F)ATLANTIS/TI
41    41  #ATLANTIS(5W)DEEP
42    42  #METALLIFEROUS OR METALLOGENESIS OR HYDROTHERMAL(W)DEPOSITS
43    43  #MODEL(F)PROCESS(F)FORMATION(F)CRUST/TI
44    44  #TRACE(W)ELEMENT(W)MOBILITY/TI
45    45  #RIDGE(F)HOT(F)BRINES/TI
46    46  #HOT/TI
47    47 C31-46/+
48    48 C30*47
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